ADDITIONAL NOTES ON *Livoneca neocyttus* (ISOPODA: CYMOTHOIDAE)

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Abstract. Additional descriptive notes are given from New Zealand specimens of *Livoneca neocyttus* Avdeev, 1975 an ectoparasite of deepwater oreosomatid dories. The host/parasite relationship is discussed in terms of specific hosts, site selection and host tissue damage.

Livoneca neocyttus Avdeev, 1975 was described briefly from specimens found as parasites of the oreosomatid dory *Neocyttus rhomboidalis* Gilchrist, 1906 in the New Zealand region. Since that time a number of deepwater fishing surveys off these coasts, completed as a preliminary to the declaration of Territorial Sea and the exploration of a 200-mile Exclusive Economic Zone, have produced a wider base for data collection. Samples of fishes, particularly dories, were used here to obtain specimens of cymothoid parasites, and to reassess the distribution and host specificity of these isopods. Specimens of *Livoneca neocyttus* were recovered from three genera of oreosomatid dories, *Allocyttus* sp., *Neocyttus rhomboidalis* and *Pseudocyttus maculatus* Gilchrist, 1906 but were notably absent from the related deepwater zeid *Cyttus traversi* Hutton, 1872.

Somewhat more detailed accounts of morphometric and meristic characters of *Livoneca neocyttus* are given here after a study of specimens from a wider range of the life history than reported by Avdeev (1975). Marsupial post-hatch larval states are described for the first time. Like other cymothoids, *L.neocyttus* is a protandrous hermaphrodite; the roles of female dominance and site selection as evidenced from capture records are discussed.

Family CYMOTHOIDAE

Genus **Livoneca** Leach, 1818

The spelling of the genus *Livoneca* Leach, 1818 deserves further comment since some recent authors, Bowman (1960), Trilles (1973, 1976), Avdeev (1975, 1978), Brusca (1981), indicate that by following Leach's usual pattern of anagrams the genus word *Livoneca* constitutes an incorrect original spelling and should be written as *Lironeca*. Justification for this arrangement was given by Monod (1931), who cited several ink corrections, reputedly in Leach's handwriting, to an offprint of Leach (1818) in the library of the Paris Museum. However, a modern interpretation (Article 32, International Code of Zoological Nomenclature) would regard those corrections as existing in manuscript form only and do not constitute publication. The original

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spelling of the genus *Livoneca* is used here and a recent explanation of Leach's names (Holthuis 1978) for a number of cymothoid genera is followed.

Livoneca neocyttus Avdeev, 1975 (Figs.1-10)

Livoneca neocyttus Avdeev, 1975, *Parazitologiya* (*Leningrad*) 9(3):247-251 figs. 1,2.

FEMALE

A large sized cymothoid isopod (Fig.1), total lengths for ovigerous females 48-66 mm. Body narrowly elliptical reaching greatest width over pereonite 5. Cephalon broadly triangular, blunt at apex, width 1.2-1.5 times length. Eyes oval, set at postero-lateral corners, moderately large but occupy proportionally less of head with increasing body size. Antenna 1 of eight segments, antenna 2 of fourteen segments; basal segments of antennae separated. Maxilliped (Fig.2) broadly expanded in ovigerous females, weakly setose along the anterior border. Maxilla 2 (Fig.3) with minute surface sculpturing, terminated by four stout curved hooks. Maxilla 1 (Fig.4) with five (2+3) apical hooks. Mandible (Fig.5) glove-like, terminated by a single blunt spine; mandibular spines meet in opposition at body midline. Mandibular palp of three segments, terminal article weakly setose, especially in smaller size individuals. Pereon segments minutely stippled in patches; patches occupy less surface area on each successively posterior segment. Pereonite 5 widest and longest, pereonites 1,3,4,6 subequal, pereonites 2 and 7 are shortest. Antero-lateral angles pereonite 1 acute, junction with cephalon weakly sinuate. Antero-lateral edges pereonites 2,3 and occasionally 4,5 are raised, almost bulbous. Pereonites 4-7 with a shallow transverse groove towards each postero-lateral angle. Epimera of pereonites 2-7 relatively inconspicuous when viewed from above; but increase in surface area posteriorly, rarely overlapping.

Pereopods of similar size but progressively larger from pereopod 1 to pereopod 7. Prehensile basos of all pereopids with non-tubercular carina, last four pairs strongly carinate.

Five imbricating pairs of oostigites in ovigerous females, developing anteriorly in an alternating sequence from posterior right, which is also outermost.

Pleonites sub-equal in length, partially overlapped by pereonite and coxa of segment 7. Pleon slightly raised in dorsal midline forming a short, flattened ridge. Pleopoda similar in shape, slightly decreasing in size posteriorly. Appendix masculina of pleopod 2 (Fig.6) can persist into late developmental stage of female. Inner basal segment margin of pleopods 1-4 fringed with 7-12 natatory hairs. Pleotelson dome shaped, posterior margin usually symmetrical. Uropoda relatively small, not easily seen from dorsal aspect and tending to lie under the curved pleotelson margin. Exopoda only fractionally longer than endopoda.

MALE

Males relatively large, total lengths 20-39 mm, general body shape narrowly eliptical. Pleonites not abruptly narrower than pereonite 7.

Fig. 1. *Livoneca neocyttus.* Dorso-lateral view of mature female.

Cephalon broadly triangular, broadly rounded at apex, and immersed in first pereonite. Eyes occupying proportionally greater area of head than in females. Antenna 1 of eight articles, segments 4-8 inclusive bear clusters of setae, directed posteriorly; one or two degenerate spines on segment 3 and segment 8. Antenna 2 of fourteen segments (6+8), degenerate natatory hairs persist on segments 4-6 inclusive. Mouth parts generally as described for females. Maxillipeds slender and exopoda rudimentary. Mandibular palp armed with short spines, eleven on segment 2, and six on segment 3; three apical flagella present.

Pereonites 3,4,5 widest, but when viewed inclusive of epimera (which increase in area, posteriorly) the pereon appears more or less straight-sided. Pereopods of similar shape increase slightly in size posteriorly. Basos of pereopods with low carina. Pereopods 4-7 with a few short spines occurring distally on ischium, merus, carpus and along inner border of propodus; their presence and numbers not consistent amongst all males.

Pleonites exposed with pleopoda of similar form to those of females. Appendix masculina on pleopod 2 reaches to lower edge of endopod in larger males. Short degenerate hairs may persist along inner margines of endopoda of pleopoda 2.

JUVENILES

A discussion of juvenile stadia is somewhat restricted by the availability of material. Only six larviparous females were studied and free-living juveniles were not seen amongst potential host fishes. Marsupial post-hatch ("post-manca" Brusca 1978) generally resemble slender males, though at least two stadia or instars could be identified. Within any one brood pouch the oldest post-hatch were at the same stage of development even though individuals varied slightly in total body length.

First instar. Total lengths 5.9-7.0 mm. Cephalon pointed apically almost triangular. Eyes occupying a very large area of dorsolateral surface. Body slender, straight sided, widths of pereon and pleon more or less the same. Seventh pereon segment generally incomplete, exceptionally short, segmentation from segment six often difficult to distinguish. Seventh pair of pereopods absent. Precursory hairs visible through unpigmented segment walls of the appendages.

Second instar. Total lengths 6.2-7.3 mm. Cephalon broad apically, profile more semicircular than triangular. Eyes less prominent than those of the first stadia. First antenna of eight segments bearing clusters of short spines and flagella (Fig.7). Second antenna with thirteen segments with natatory hairs and short spines on all but the proximal three segments (Fig.8). Mouth parts similar to males but terminal hooks on maxilliped and maxilla not strongly developed. Mandible (Fig.9) with a palp bearing flagella and short setae on segments 2,3. Segment 2 with 11 short setae, segment 3 with 6 short setae and 3 flagella.

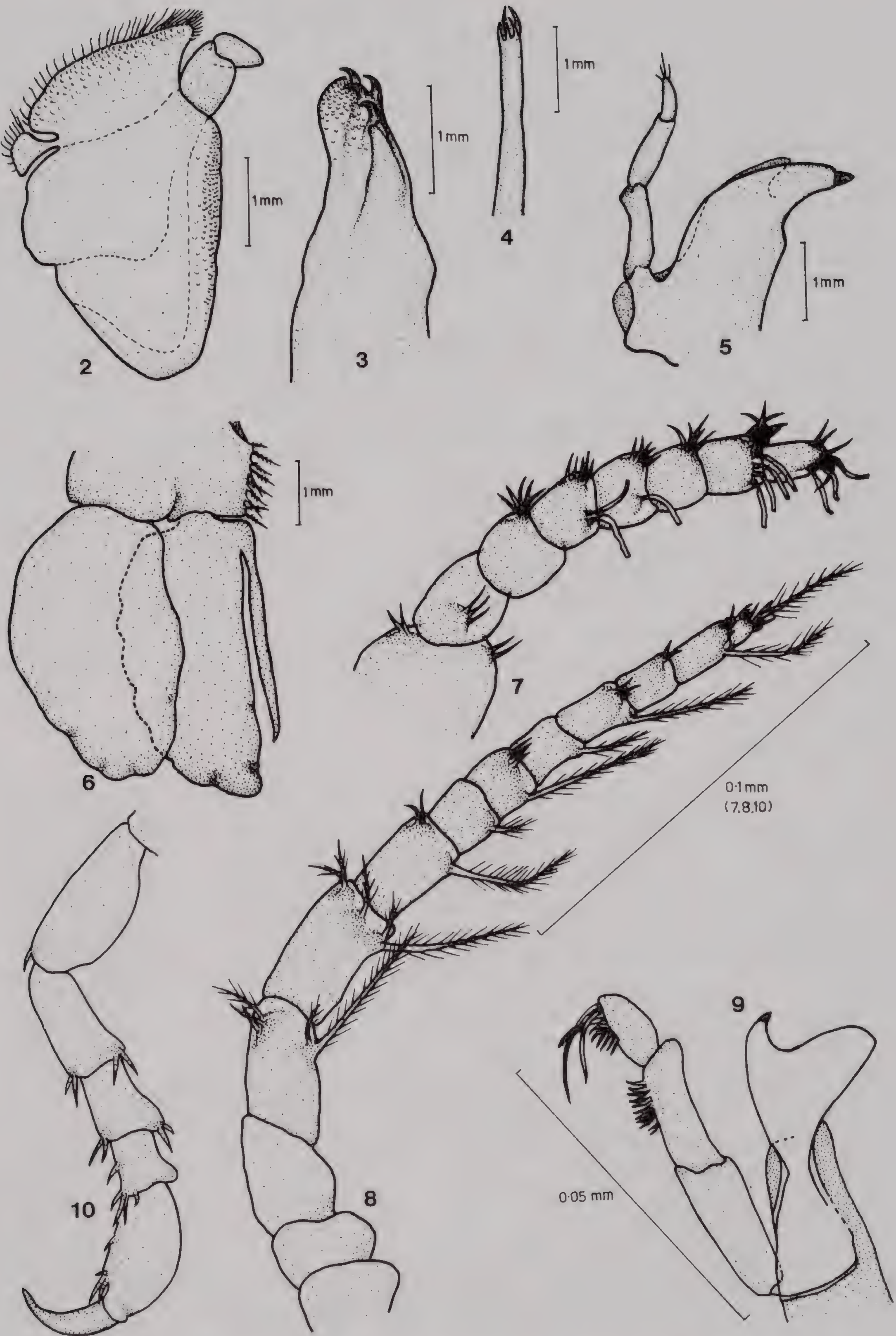
Body shape elliptical, pereon segments increasing in width, posteriorly to segment 6. Pereopods more or less of equal size armed with short spines (Fig.10). Seventh pereonite, immature, distinctly shorter, seventh pereopods undeveloped.

Pleon and pleopoda as in males but appendix masculina absent. Telson and uropoda bear marginal natatory hairs and spines. Numbers from counts of a dissected specimen (TL 6.3 mm): exopoda hairs 26, spines 7; endopoda hairs 22, spines 1; telson hairs 32. Telson with patches of short hairs over dorsal surface.

DISTRIBUTION. Specimens of *L.neocyttus* collected in this study came from exploratory fishing over continental slope topography (470-930 m) to the south-east of New Zealand, including areas of the Chatham Rise, Pukaki Rise and Bounty Plateau. Since that time oreosomatids have been fished from a number of additional areas, generally in the depth range 500-1100 m, including the Wairarapa Coast, Colville Ridge, Whanganella Bank and the Campbell Plateau. Although no evaluation of records of parasites has been available to date, the potential for a much wider parasite distribution would seemingly be available throughout the New Zealand region.

Material examined

1 ♀ 1 ♂ Chatham Rise 42°51′S, 178°61′E, 508 m Shinkai Maru Stn 51 9 Nov 1975. 1 ♀ Chatham Rise 43°07′S, 179°47′E, 550 m Shinkai Maru Stn 61 11 Nov 1975. 1 ♀ Chatham Rise 42°48′E, 178°27′E, 925 m Shinkai Maru Stn 15 Nov 1975. 1 ♀ Chatham Rise 42°54′S, 175°22′E, 582 m Shinkai Maru Stn 27 Apr 1976. 2 ♀ 1 ♂ Chatham Rise 42°50′S, 176°22′E, 552-520 m Shinkai Maru Stn 75 19 May 1976. 1 ♂ Chatham Rise 44°28′S, 174°38′E, 750 m Shinkai Maru Stn 226 8 Jan 1977. 1 ♀ 1 ♂ Pukaki Rise 48°54′S, 175°39′E, 930-912 m Shinkai Maru Stn 241 12 Jan 1977. 19 ♀ 12 ♂ Chatham Rise 44°00′, 177°54′E, 998-813 m Kaiyo Maru Stn 26 22 Dec 1977. 1 ♀ Chatham Rise 44°03′S, 179°06′E, 750 m Wesermunde Stn 030 27 May 1979.



Figs. 2-10. *Livoneca neocyttus*. 2-5. Female mouthparts. 2. Maxilliped. 3. Maxilla 2. 4. Maxilla 1. 5. Mandible. 6. Mature female, pleopoda 2 showing persistent appendix masculina. 7-10. Juvenile. 7. antenna 1. 8. Antenna 2. 9. Mandible. 10. Pereopod 5.

Host specificity. A general survey for isopod parasites amongst the New Zealand deepwater fish fauna suggests *Livoneca neocyttus* has a narrow range of hosts, these being limited entirely amongst oreosomatid dories. Avdeev (1975) reported *Neocyttus rhomboidalis* as the sole host fish species, but in this study adults of three oreosomatid genera; *Allocyttus* sp. (TL.19-44cm), *Neocytus rhomboidalis* (TL.15-35cm) and *Pseudocyttus maculatus* (TL.17-43cm) have been found as hosts.

The levels of parasitism within these host fishes showed considerable variation; *Allocyttus* sp. (n=64) fish with parasites 26, *N.rhomboidalis* (n=52) fish with parasites 4, *P.maculatus* (n=40) fish with parasites 3. Because of small sample sizes and mixed (non-random) sampling methods no conclusion can be drawn from these results; both live capture and selective preserved material are included in these data. The results given by Avdeev (1975) suggesting an infestation level of 30% in *N.rhomboidalis* (n=30) appear to have similar disadvantages against interpretation.

Amongst other potential fish hosts it was found that the zeid dories, particularly *Cyttus traversi* captured from the same location and over depth ranges 80-600 m, were parasitised only by the more widespread cymothoid *Livoneca raynaudii* Milne Edwards. Avdeev (1975) reported similar results from fishes examined for his study.

DISCUSSION

Site Selection

Livoneca neocyttus is a protandrous hermaphroditic parasite in which a single maturing, or ovigerous female occupies the host's buccal cavity, while males and juveniles are restricted to skin sites near the branchial arches and/or the opercular membrane. Unlike many other instances of cymothoid parasitism, the host's tongue (glossohyal/hyal apparatus) is not used as a principal site of attachment by females. They instead attach to the soft membrane lining the room of the buccal cavity facing towards the host's mouth opening. This specific site of attachment and orientation was common to twenty-eight of the thirty-three females recovered. As a principal position it nevertheless provides best environmental circumstances, first use of water and food supply. The situation also has an upstream advantage in the probable chemical control ("neurohormonal" Trilles 1969; "exogenous stimuli" Brusca 1978) over individuals in posterior, branchial or opercular sites. When present, an accompanying juvenile or male (rarely more than one specimen) generally occupied a posterobuccal position, near the gill arches, rather than alternative potential sites on the gill lamellae or linings to the opercular chamber.

Site damage

Instances of skin and gill damage reported widely amongst hosts of other cymothoid isopods (Stephenson 1976, Brusca 1981) were generally not prevalent

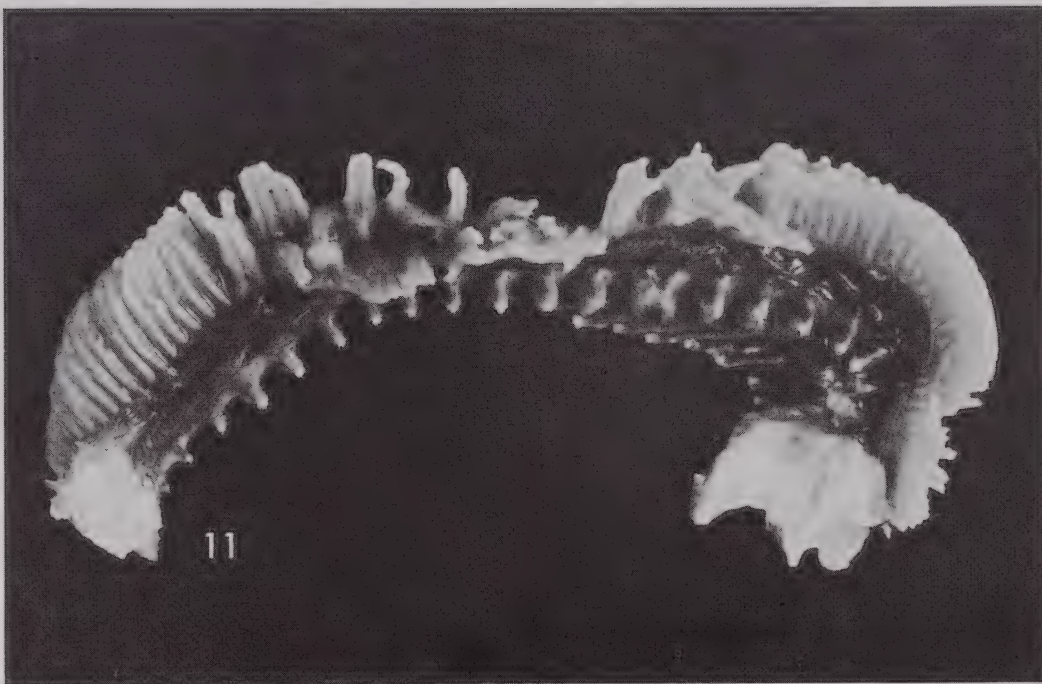


Fig. 11. *Neocyttus rhomboidalis.* Excised first branchial arch (left side) showing gill filament contact damage.

amongst fish studied in this report. Slight skin abrasion together with a patch of clotted blood, somewhat imprinting the parasite's ventral head and thoracic regions, was apparent on the removal of some females. One instance of gill filament distruption (Fig.11) was recorded after the removal of a male from an adjacent attachment site in the branchial chamber. Damage here did not extend beyond the area of immediate contact.

It seems likely that in oreosomatid dories the relatively large volume of the buccal chamber, together with *L.oreosoma* having sites of attachment generally not including the tongue or branchial arches, are features that reduce the potential for physical damage. Of particular interest, however, is that the oreosomatids have stubby and sharply ornamented gill rakers. From a parasite perspective the selection for suitable sites of attachment may not necessarily be those of the highest preference but those governed by the need to avoid the gill rakers.

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